

Systematic review of psychosocial benefits obtained with interventions to promote active commuting in schools

Revisión sistemática sobre los beneficios psicosociales obtenidos con intervenciones para promover el desplazamiento activo al colegio

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Abstract: Active commuting to schools has decreased in the last few years. The main objectives of this review were to determine which interventions are being carried out to promote active commuting, to know the quality of the research, and to analyze which psychosocial parameters can be improved. The bibliographic search was carried out in the databases of Medline, Sport Discus, Scopus, Web of Science, and Google Scholar... Finally, there were selecting a total of 23 investigations. The most frequent action is to implement programs to promote active commuting (91.30%). There are few data as yet on interventions, and approximately half of the studies fail to improve active commuting data (47.83%). Psychosocial health *is not just studied* only 1 study tested variables of psychosocial health. It is important to increase the number of studies, to randomize them, control external contaminants, increase the duration, and increase the psychosocial health studies.

Key words: active commuting, school, review, psychosocial.

Resumen: El desplazamiento activo al centro educativo ha disminuido en los últimos años. Los objetivos principales de esta revisión fueron determinar qué intervenciones se están llevando a cabo para promover el desplazamiento activo, conocer la calidad de las investigaciones y analizar qué parámetros psicosociales se han estudiado. La búsqueda bibliográfica se realizó en las bases de datos de Medline, Sport Discus, Scopus, Web of Science y Google Scholar. Finalmente, se seleccionaron 23 investigaciones que desarrollaban intervenciones para fomentar el desplazamiento activo. La intervención más frecuente es implementar programas para promover el desplazamiento activo (91.30%). Existen pocos estudios con intervenciones, y aproximadamente la mitad de los estudios no logran mejorar los datos de niveles de desplazamiento activo (47.83%). La salud psicosocial no ha sido apenas estudiada, tan solo en 1 estudio se midieron las variables de salud psicosocial. Es importante aumentar el número de estudios, aleatorizarlos, controlar contaminantes externos, aumentar la duración y desarrollar estudios de salud psicosocial.

Palabras clave: desplazamientos activos, centros educativos, revisión, psicosocial.

1. Introduction

Active Commuting (AC) is defined as the action of going to school using transportation that involves metabolic expenditure, such as walking or bicycling (Chillón, Evenson, Vaughn, & Ward, 2011; Mandic et al. 2015, Segura-Díaz, Farrier -Colmenero, & Chillón, 2015). Child well-being is a widely used term in research on children and young people, which Dodge, Daly, Huyton, and Sanders (2012) defined as a multidimensional construct that encompasses psychological, physical, and social dimensions. Waygood, Friman, Olsson, and Taniguchi (2017) extended the dimensions of child well-being to five (Physical, Psychological, Cognitive, Social, and Economic). In their review, these authors showed how AC might influence the 5 dimensions, but despite this, most studies only analyze the physical dimension. In recent years, research on AC has increased in schools, as shown by some

systematic reviews (Lee, Orenstein, & Richardson, 2008; Panter, Jones, & Van Sluijs, 2008, Faulkner, Buliung, Flora, & Fusco, 2009; Lubans, Boreham, Kelly, & Foster, 2011; Chillon et al., 2011; Wong, Faulkner, & Buliung, 2011; Larouche, Saunders, John Faulkner, Colley, & Tremblay, 2014; Villa et al., 2018).

Obesity has reached epidemic proportions worldwide. The World Health Organization (WHO) calls obesity “the epidemic of the 21st century” because the risk of contracting diseases increases with Body Mass Index (BMI: Weight (kg) / Size (m)²). Chaput et al. (2018) analyzed obesity levels in different countries in children aged 9 or 11 years, finding high levels in China (24.5%), Brazil (21.5%), United States (17, 5%), and Portugal (16.4%). Obesity data in Spain have increased from 7.4 to 17% in the last 25 years, becoming a public health problem. Currently, 23% of Spanish adults are obese and 38% are overweight. Recent studies in the age range of 6 to 9 years showed a prevalence of 23.2% of overweight (22.4% in boys and 23.9% in girls) and 18.1%

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of obesity (20.4% in boys and 15.8 % in girls) (Ministry of Health, 2016). In this line, in children and adolescents, the percentages reach 25% (overweight) and 15% (obesity) (Vilalonga et al., 2017).

One of the possible reasons for these high levels of obesity are the high rates of sedentary lifestyle of contemporary society, reaching 40% in women and 32% in men (ENSE, 2018). There are several definitions of the term sedentary lifestyle. From the point of view of the time dedicated to performing physical activity (PA), an individual who does not perform at least 30 minutes of moderate PA for most days of the week is considered sedentary (Pate, O'Neill, & Lobeto, 2008). In this sense, in recent years, the way in which students actively commute to school is analyzed, with the aim of clarifying the reasons for a sedentary lifestyle, (González, Ruiz, & Garzón, 2016).

High levels of sedentary lifestyle are causing the worldwide epidemic of obesity to increase. For example, in Spain, only 47.5% of the population aged 6 to 18 years comply with the recommendations of daily PA. As children grow older, inactive levels increase, with some studies showing alarming data. In Spain, at around age 12-13 years, 36% of the Spanish population does not practice the necessary PA on a regular basis (Román, Serra, Ribas, Pérez, & Aranceta, 2008).

In this sense, the WHO (2010) states that it is necessary to establish an energy balance to avoid obesity and, for this purpose, it recommends children and young people (5 to 17 years) to accumulate at least 60 minutes of daily PA of moderate or vigorous intensity (PAMV).

In the last times the problem is greater, Covid-19 confinement substantially reduced physical activity levels, increased both screen exposure and sleep time in Spanish children and adolescents (Lopez-Bueto et al., 2020).

Students who actively travel to the school have higher levels of PA, higher levels of self-confidence and independence, and a lower risk of overweight (Alexander et al., 2005; Salmon, Timperio, Cleland, & Venn, 2005; Southward, Page, Timperio et al., 2006; Wheeler, & Cooper, 2012).

Researchers from different disciplines, such as public health and urban design and transportation have analyzed multiple factors (personal, environmental, and social) that affect AC. Based on the findings, various interventions have been developed and implemented. However, most interventions have proven insufficient to change children's active travel (Lu, McKyer, Lee, Wang, Goodson, & Ory, 2014). These authors indicate the lack of theoretical background in the design and not considering psychological factors and limitations in the use of analytical techniques as limitations that hinder the interventions' success.

In 2011, a review of 14 studies that had developed interventions to promote AC was published, concluding that they were not always successful (Chillón, et al., 2011). This review

only found important or very important effects in three of the interventions. This is due to the great heterogeneity of the studies and their lack of consistency. The authors also highlighted the great variety of factors that influence AC (environmental characteristics, economic level of families, use of Information and Communication Technologies [ICTs, for example: smart phone, computer...], (family aspects, cultural elements, etc ...), making them difficult to control in the design of the interventions.

Smith, Norgate, Cherrett, Davies, Winstanley, and Harding (2015) conducted a review of interventions with safe school routes "Walking school buses" (walking school bus is a group of children walking to school with one or more adults), finding evidence of the benefits in increasing the number of trips with this type of intervention. Regarding the improvements obtained, most studies focus on enhancement of PA and health, but only a few analyze aspects related to enjoyment and socialization produced by AC.

Subsequently, Villa, Barranco, Evenson, and Chillón (2018) updated the 2011 study with a review of 23 articles about interventions. They found a clear increase in research to encourage AC to schools, but the articles lacked scientificity in terms of the design of the interventions and the representativeness of the samples. Moreover, the levels of effectiveness of the improvements achieved through the interventions were low.

The main objective of this review is to update the information on interventions whose aim is to encourage AC to school. A secondary objective is to identify the psychosocial benefits of the participants who changed their way of traveling through the intervention programs carried out.

The hypothesis of the present work is that research with intervention in active commuting is increasing, but on few occasions psychosocial aspects are analyzed.

2. Methods

The bibliographic search was carried out in the databases of Medline, Sport Discus, Scopus, Web of Science, and Google Scholar. The following combination of keywords was established as search criteria: "TITLE-ABS-KEY ((child OR children OR kids OR youth) AND (transport OR commuting) AND active AND barriers AND school AND intervention). The time limit was October 6, 2018.

In the initial search, a total of 238 articles were found, distributed in the following databases: Medline (13), Sport Discus (70), Scopus (75), Web of Science (74), and Google Scholar (6). The next step was to identify the duplicates, leaving 127 articles by eliminating a total of 111 duplicates. Titles and abstracts were read to apply the established inclusion criteria (Figure 1):

- Articles published after the year 2013.
- Studies conducted with trips to the educational center and specifying school age.
- An intervention was carried out for the investigation.
- Psychosocial benefits generated by AC were examined.

two researchers independently. If there was any discrepancy, a third investigator intervened to reach consensus. Subsequently, the reference list of the selected studies was reviewed to identify additional studies. The full texts of these articles were retrieved. If it was not possible to retrieve it from the databases, the author was contacted to request the full text of the research article, as it could still be in the editing process. Later, the abstract was read and / or full text of the selected articles. The authors of the articles who had restricted access to the full text were contacted in order to access the document.

Selection of works

After the bibliographic search, the authors carried out a reading of the title to eliminate duplicate articles. The abstracts and / or full text of the selected publications were analyzed by

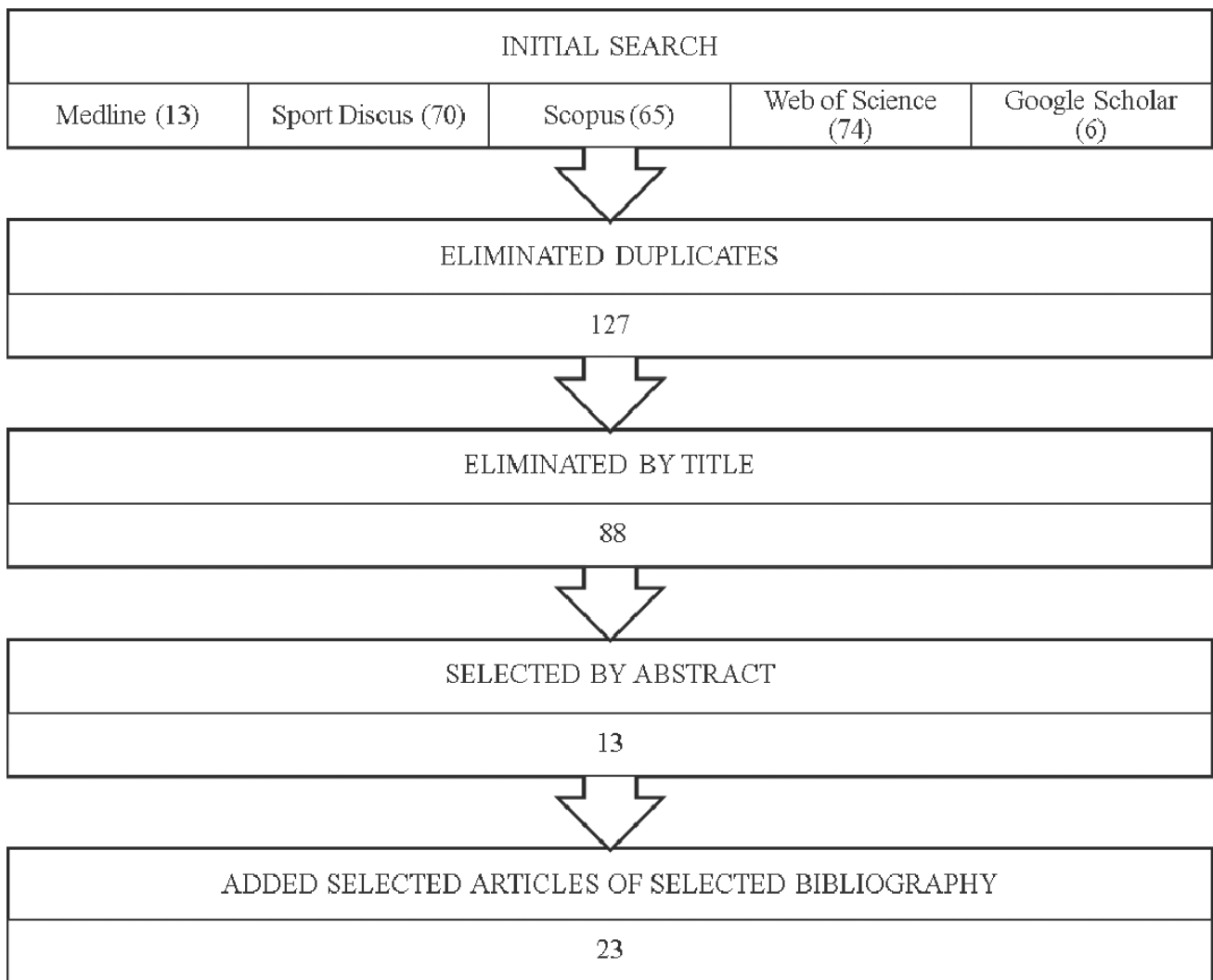


Figure 1. Bibliographic search process.

3. Results

3.1. Evaluation of the quality and level of evidence

In the previously developed systematic reviews (Chillón et al., 2011; Smith et al., 2015; Chillón et al., 2018), there were numerous non-randomized studies (NRS). This type of articles has a higher risk of bias, and it is therefore necessary to control the quality of the articles to determine whether they have taken the confounding factors into account (Muñoz & Ruiz Morales, 2018). To this end, we performed an analy-

sis of the quality of the interventions using the ROBINS-I scale (Sterne et al., 2016) to assess the risk of bias in studies of non-randomized interventions. An updated version of the ROBINS-I tool was used (adapted by Muñoz and Ruiz, 2018). Thus, the following variables were analyzed in each article: confusion factor, participants, randomization of groups, classification of interventions, deviation of planned intervention, lost data, measurement of outcomes and selection of reported outcomes. For the adaptation, the review by a group of experts of the tool was used, leaving the domains to be analyzed as follows:

Table 1. Adaptation of Robis-I.

	Domain	Explanation
Prior to the intervention	Bias due to confounding factors	One or more prognostic factors are associated with both the intervention received at the beginning of the study and the outcome. Some examples of prognostic factors that may appear in climatology (in interventions of a few days, orography of the terrain, level of sports practice ...).
	Bias for participants	When the exclusion of some participants, or the initial follow-up time, are related to exposures and outcomes. For example, when participants are excluded because they have not taken all measures of displacement or injuries during the intervention.
	Bias by group randomization	When distribution between control group and experimental group does not occur randomly.
During intervention	Bias in the classification of interventions	The same interventions are not applied in different experimental groups.
	Bias due to deviation of planned interventions	When there are systematic differences between the interventions proposed in different schools.
After the intervention	Bias for lost data	The lost data are distributed differently between different schools.
	Bias in the measurement of outcomes	When there are differential or non-differential errors in the measurement of outcomes. For example, when the evaluator knows the intervention status, or there are different methods to evaluate the outcomes in the different intervention groups.
	Bias in the selection of reported outcomes	Selective reporting in the results in a way that makes it dependent on the findings, avoiding that the estimates can be included in a meta-analysis.

3.2 Selection of studies

After the search and review of the articles, a final sample was achieved of 23 articles that conducted interventions to promote AC to school between 2013 and 2018.

3.3 Study population

The 23 studies analyzed are shown in Table 1 with their main characteristics. Of these studies, 13 were developed in Europe (Buckley, Lowry, Brown, & Barton, 2013; Christiansen, Toftager, Ersbøll, & Troelsen 2014; Coombes & Jones, 2016; Ducheyne, Bourdeaudhuij, Lenoir, & Cardon, 2014; Goodman, Van Sluijs, & Ogilvie, 2016; Gonzalez, 2015; Lindqvist & Rutberg, 2018; Østergaard, Støckel, & Andersen, 2015; Rutberg & Lindqvist, 2018; Stewart, Moudon, & Claybrooke, 2014; Vanwollegghem, D'Haese, Van Dyck, De Bourdeaudhuij, & Cardon, 2014; Villa-González, Ruiz, Ward, & Chillón, 2015; Villa-González,

Ruiz, Mendoza, & Chillón, 2017), 7 in North America (Bungum, Clark, & Aguilar, 2014; Lu, McKyer, Lee, Wang, Goodson, & Ory, 2014; Macridis, Garcia Bengoechea, McComber, Jacobs, & Macaulay, 2016; Sirard, McDonald, Mustain, Hogan, & Helm, 2015), 1 in Australia (Crawford & Garrard, 2013) and 1 was jointly developed in Europe and North America (Hunter, de Silva, Reynolds, Bird, & Fox, 2015).

The year 2014 was the greatest research production, with 9 projects. Of the studies examined, 16 focused on analyzing early childhood or primary education (up to 12 years) (Buckley et al., 2013; Bungum et al., 2014; Coombes et al., 2016; Crawford et al., 2013; Ducheyne et al., 2014; Goodman et al., 2016; Hoelscher et al., 2016; Lindqvist et al., 2018; Lu et al., 2014; Macridis et al., 2016; Østergaard et al., 2015; Rutberg et al., 2018; Vanwollegghem et al., 2014; Villa-Gonzalez, 2013; Villa-González et al., 2017; Villa-González et al., 2015), and 7 studies included adolescents (Christiansen et al., 2014; Hunter et al 2015; MacDonald et al., 2014; Mammen

et al., 2014; Marinovic et al., 2014; Sirard et al., 2015; Stewart et al., 2014.) The number of participants differs in the studies depending on whether they analyze by schools or by students. In the former case, a total of 1082 schools were studied, the study with the smallest sample was conducted with 39 schools (Sirard et al., 2015) and the most extensive study was done with 801 schools (McDonald et al., 2014).

Regarding the studies that quantified the number of students, a total of 14240 students were tested. In this sense, 5 studies had fewer than 100 participants (Coombes et al., 2016; Ducheyne et al., 2014; Lindqvist et al., 2018; Rutberg et al., 2018; Vanwollegghem et al., 2014), 6 studies had between 100 and 1000 participants (Buckley et al. 2013; Lu et al., 2014; Macridis et al., 2016; Villa-Gonzalez, 2015; Villa-Gonzalez et al., 2015; Villa-Gonzalez et al., 2017), and 6 had more than 1000 participants (Bungum et al., 2014; Christiansen et al., 2014; Crawford et al., 2013; Goodman et al., 2016; Hunter et al., 2015; Østergaard et al., 2015). Regarding the design of the investigations, 8 of them did not use a control group to analyze the effects of the intervention. In none of the cases were the participants randomly distributed to the control group or the experimental group.

3.4 Description of interventions

The duration of the interventions is one of the most variable aspects, finding one-day interventions (Bungum et al., 2014) up to 6-year interventions (Stewart et al., 2014). The average duration of the interventions was 52.23 weeks (1 year). We found 18 interventions on 1 year or less (Buckley et al., 2013; Bungum et al., 2014; Coombes et al., 2016; Crawford et al., 2013; Ducheyne et al., 2014; Goodman et al., 2016; Hunter et al., 2015; Lindqvist et al., 2018; Lu et al., 2014; Mammen et al., 2014; Marinovic et al., 2014; Østergaard et al., 2015; Sirard et al., 2015; Villa-Gonzalez 2015; Villa-Gonzalez et al., 2015; Villa-Gonzalez et al., 2017; Rutberg et al., 2018; Vanwollegghem et al., 2014), and 6 interventions lasting more than 1 year (Christiansen et al., 2014; Hoelscher et al., 2016; McDonald et al., 2014; Mammen et al., 2014; Macridis et al., 2016; Stewart et al., 2014).

The participation of parents and/or teachers in the programs is a relevant aspect, and when analyzing the data, we found 13 studies in which the parents participated (56.5%) (Christiansen et al., 2014; Lindqvist et al., 2018; Lu et al., 2018; Macridis et al., 2016; Mammen et al., 2014; Marinovic et al., 2014; McDonald et al., 2014; Rutberg et al., 2018; Stewart et al., 2014; Vanwollegghem et al., 2014; Villa-Gonzalez, 2015; Villa-Gonzalez et al., 2015; Villa-Gonzalez et al., 2017), and 14 in which the teachers participated (60.87%) (Bungum et al., 2014; Coombes et al., 2016; Crawford et al., 2013; Ducheyne et al., 2014; Hoelscher et al., 2016; Østergaard et al., 2015; Sirard et al., 2015).

Regarding the approach or typology of the interventions developed to promote AC, we can classify them in the following strategies:

- Infrastructures: Creation of bicycle racks, increase of signaling, creation of roads, start-up of signaling points.
- Programs: Development of training sessions with students, parents and/or teachers. Road safety education sessions, bicycle handling, safety, creation of meeting points, start-up of safe supervised school roads ...
- Promotion: Dissemination through brochures, posters, advertisements ...
- Policies: Changes in regulations, new distribution of the police, etc.

Regarding the selected studies, 26.09% (n = 6) performed interventions with improvements in infrastructures (Coombes et al., 2016; Hoelscher et al., 2016; Mammen et al., 2014; McDonoald et al., 2014; Østergaard et al., 2015; Stewart et al., 2014), 8.70% (n = 2) developed political interventions (Marinovic et al., 2014; Sirard et al., 2015), 21.74% (n = 5) conducted advertising and promotion activities (Crawford et al., 2013; Macridis et al., 2016; Mammen et al., 2014; Marinovic et al., 2014; McDonald et al., 2014), and 91.30% (n = 21) developed programs to promote AC (Buckley et al., 2013; Bungum et al., 2014; Christiansen et al., 2014; Coombes et al., 2016; Crawford et al., 2013; Ducheyne et al., 2014; Goodman et al., 2016; Hoelscher et al., 2016; Hunter et al., 2015; Lindqvist et al., 2018; Lu et al., 2014; Macridis et al., 2016; Mammen et al., 2014; McDonald et al., 2014; Østergaard et al., 2015; Rutberg et al., 2018; Stewart et al., 2014; Vanwo. llehem et al. 2014; Villa-Gonzalez, 2015; Villa-Gonzalez et al., 2015; Villa-Gonzalez et al., 2017).

3.5. Effectiveness of interventions

In 12 of the 23 (52.17%) studies, an increase of AC to school was achieved. In 3 studies, the data were not shown, and in 8 studies (34.78%), no changes were achieved in terms of students' AC habits. Other aspects achieved with the interventions were improvements in the handling of the bicycle (Ducheyne et al., 2014), improvements in the perception of health, happiness, and making friends (Hunter et al., 2015), parents' perception of safety (Rutberg, 2018), and improvement in the strength levels in girls' lower limbs (Villa-Gonzalez, 2015).

3.6. Psychosocial health

Taking into account the studies analyzed, 100% measured AC to school, but some also tried to relate this type of travel to health-related variables. In this sense, 4 of the studies fo-

cused on physical health variables, such as physical condition, obesity, daily PA level, cardiorespiratory capacity, etc. (Østergaard, 2015; Vanwolleghem, 2014; Villa-Gonzalez, 2015;

Villa-Gonzalez et al., 2017). However, only 1 study tested variables of psychosocial health, such as self-confidence and security (Rutberg & Lindqvist, 2018).

Table 2. Selected researches.

	Country	Environment	Age	P	CG	EG	P. Pa	P. Te	Duration	Variable	E.I
Buckley et al., 2013	Russia	U	5-11	Walk: 475 Bike: 275	1 school	2 schools			Walk:3 days Bike:5 days	No. of children who arrive actively at school	Increase
Bungum et al., 2014	USA	U	5-11	1336	698	638	No	Yes	1 day	Level of active commuting	No
Christiansen et al., 2014	Denmark	U	11-14	1010	516	494	Yes	Yes	2 years	No. of active trips. Level of promotion of active commuting by parents	No
Coombes y Jones, 2016	England	U	8-10	80	29	51	No	No	9 weeks	No. of active commuting	Increase
Crawford y Garrard, 2013	Australia	U y R	9-12	1981	2 school	2 schools	No	No	1 year	Level of travel	Increase
Ducheyne et al., 2014	Belgium	U	9-10	94	35	34	No	No	4 weeks	Active weekly travel level. Level of handling of the bicycle	No
Goodman et al., 2016	England		10-11	3336	773	2563	No	No	4 sessions of 2 hours	Active weekly commuting level	No
Hoelscher et al., 2016	USA		9-10	78 Schools	23	21	No	No	3 years	No. of active travel	Increase
Hunter de et al., 2015	England and Canada	U	9-13	2068					4 weeks	No. of weekly active travels	No data
Lindqvist y Rutberg, 2018	Sweden	U	7-8	42	0	42	Yes	Yes	4 weeks	Qualitative study through Focus Group and open letters to measure level of satisfaction with the program	Increase
Lu et al., 2014	USA	U y R	8-9	857			Yes	Yes	24 weeks		No data
Macridis et al., 2016	Canada	R	6-12	331	0	331	Yes	Yes	19 months	Level of active weekly commuting (questionnaire parents and students). Parental barriers and conditions to allow children to go actively (Questionnaire)	No
Mammen et al., 2014	USA		6-14	106 schools		106	Yes	Yes	18 months		No
Marinovic et al., 2014	USA	U	0-17	58 schools	24	34	Yes	Yes	3 months	No. of active commuting. Attitude and beliefs of parents towards active commuting	Increase
McDonald et al., 2014	USA	U y R	6-15	801 schools	378	423	Some	Some	5 years	No. of active travels	Increase
Østergaard, Støckel, Andersen, 2015	Denmark	U y R	9-11	2401	1105	1296	No	No	12 months	No. of active travels. Index of overweight, level of physical activity and cardiorespiratory capacity.	No

	Country	Environment	Age	P	CG	EG	P. Pa	P. Te	Duration	Variable	E.I
Rutberg y Lindqvist, 2018	Sweden	U	7-8	32			Yes	Yes	4 weeks	Perception of parental safety. Self-confidence	No data
Sirard et al., 2015	USA	U	5-14	39 schools			No	No	8 months		No
Stewart et al., 2014	USA	U y R	5-18		966 schools	53 schools	Some	Some	6 years	No. of active travels	Increase
Vanwolleghem et al., 2014	Belgium	U	6-12	58		58	Yes	Yes	1 week	No. of active travels per week and number of steps per day.	Increase
Villa-González, 2015	Spain	U y R	8-12	237	96	141	Yes	Yes	6 months	Type of commuting. Physical condition associated with health.	Increase
Villa-González et al., 2017	Spain	U y R	8-11	251	110	141	Yes	Yes	6 months	Travels to the school last week. Physical activity level (Alpha Questionnaire). Resistance (20M Test), Lower train force (long jump), upper train strength (handgrip). Agility-Speed (4x10m Test). Distance to school.	Increase in bike only in boys
Villa-González et al., 2015	Spain	U y R	8-11	494	89	117	Yes	Yes	6 months	Distance to the school (Google maps). No. of active travels per week (Questionnaire)	Increase

4. Discussion

The main objective of this review is to update the information on interventions whose aim is to encourage AC to school. A secondary objective was to identify the psychosocial benefits in participants who changed their way of traveling through the intervention programs developed. In this review, 23 studies were identified that promoted AC to school among children and adolescents. Consequently, the current systematic review provides improvements and recommendations for establishing successful strategies in the public health policies by testing the published intervention investigations.

4.1. Quality of investigations

Previous reviews showed a low quality in the components of the studies (Chillon et al., 2018), which confirms our finding of a large presence of biases or lack of data in terms of the research design to assess the quality of some of the articles. The results of our analysis indicate the need to improve the quality of the studies to be developed in this area of AC, controlling the variables as much as possible to avoid biases in the investigations.

Table 3. Evaluation of bias.

Type of bias	PRESENCE OF THE BIAS	NO DATA
Bias due to confounding factors	N=17 (73,9%)	N= 2 (8,7%)
Bias for study participants	N= 20 (86,9%)	N=2 (8,7 %)
Bias in the randomization of groups	N= 19 (82,6%)	N= 1 (4,3 %)
Bias in the classification of interventions	N=9 (39,1%)	N=3 (13,0 %)
Bias due to deviation from the proposed interventions	N=1 (4,3%)	N=10 (43,5%)
Bias for lost data	N=14 (60,9%)	N=3 (13,0%)
Bias in the measurement of results	N=21 (91,3%)	N=0 (0%)
Bias in the selection of reported outcomes	N=19 (82,6%)	N=0 (0%)

Table 4. Analysis of biases in interventions on active commuting

	Bias due to confounding factors	Bias for study participants	Bias in the randomization of groups	Bias in the classification of interventions	Bias due to deviation from the proposed interventions	Bias for lost data	Bias in the measurement of results	Bias in the selection of reported outcomes
Buckley et al., 2013	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Bungum et al., 2014	No	Yes	Yes	No	No	Yes	Yes	Yes
Christiansen et al., 2014	Yes	Yes	Yes	No	No	No	Yes	Yes
Coombes y Jones, 2016	Yes	Yes	Yes	No	No	No	Yes	No
Crawford y Garrard, 2013	ND	No	No	No	No	No	No	No
Ducheyne et al., 2014	ND	Yes	Yes	No	No	No	Yes	No
Goodman et al., 2016	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Hoelscher et al., 2016	ND	Yes	Yes	Yes	No	No	Yes	Yes
Hunter de et al., 2015	Yes	Yes	Yes	ND	No	No	Yes	Yes
Lindqvist y Rutberg, 2018	ND	ND	ND	No	No	ND	No	No
Lu et al., 2014	Yes	Yes	No	Yes	ND	Yes	Yes	Yes
Macridis et al., 2016	ND	ND	Yes	No	No	Yes	Yes	Yes
Mammen et al., 2014	Yes	Yes	Yes	No	No	Yes	Yes	Yes
Marinovic et al., 2014	Yes	Yes	Yes	ND	ND	Yes	Yes	Yes
McDonald et al., 2014	Yes	Yes	Yes	No	ND	Yes	Yes	Yes
Østergaard et al., 2015	Yes	Yes	Yes	ND	ND	Yes	Yes	Yes
Rutberg y Lindqvist, 2018	Yes	Yes	Yes	Yes	ND	Yes	Yes	Yes
Sirard et al., 2015	Yes	Yes	No	Yes	No	Yes	Yes	Yes
Stewart et al., 2014	Yes	Yes	Yes	Yes	ND	Yes	Yes	Yes
Vanwollegem et al., 2014	Yes	Yes	Yes	Yes	ND	ND	Yes	Yes
Villa-Gonzalez, 2015	Yes	Yes	Yes	Yes	ND	ND	Yes	Yes
Villa-González et al., 2017	Yes	Yes	Yes	Yes	ND	Yes	Yes	Yes
Villa-González et al., 2015	Yes	Yes	Yes	No	ND	Yes	Yes	Yes

Note: ND: No data

4.2. Types of intervention and results

The duration of the interventions is a key aspect according to previous studies, as Fesperman, Evenson, Rodríguez, and Salvesen (2018) commented on the importance of increasing the duration of interventions. In this sense, the current review shows that most of the interventions still have a short duration, with 78.23% lasting less than one year.

Previous reviews found an evolution in the type of programs developed, granting great importance to parents' participation in them. In this sense, in 2011, some studies were found with parental participation (57%) (Chillón et al., 2011), and years later, in 2018, this type of studies increased (87%) (Chillón et al., 2018). In the present review, the parents were involved in the intervention in 56.5% of the studies.

4.3. Psychosocial Health

Descriptive studies have shown that students who actively travel more than 15 minutes to school have higher levels of subjective happiness and psychological well-being, as well as lower levels of psychological distress (Ruiz-Ariza, de la Torre-Cruz, Redecillas-Peiró, & Martínez-López, 2015). Studies of adults have also found a relationship between AC and psychological well-being (Martin, Goryakin, & Suhrcke, 2014). Despite these findings in descriptive studies, we found no studies of interventions to increase AC and with a view to observing the influence of the changes produced in psychosocial variables.

The present study has some limitations regarding the evaluation of the quality of the investigations, as an adaptation of the ROBINS-I was carried out, which was originally designed to evaluate non-randomized clinical studies. Its adap-

tation to AC studies involves some problems when applying the tool to the above investigations, due to lack of information about the interventions in many of the articles.

5. Conclusions

The investigations developed to increase AC are mainly based on the generation of programs that are too short (less than one year). The studies tend to use fewer than 1000 participants, and no control group is used in a large percentage of studies, which makes it difficult to draw conclusions about the effectiveness of the intervention applied.

In recent years, AC has been investigated in depth, but it is necessary to improve the quality of research, avoiding the large percentages of bias found in the published articles.

Research with intervention programs is the most common type, and it is necessary to continue defining programs to determine which are more effective. However, it is essential to increase the duration of the interventions to be able to analyze their results in depth.

Previous reviews suggest that among younger ages, active travel/commuting is inconsistently related to Physical Fitness or Physical Health and that several factors should be considered to compare the effectiveness of active commuting in improving Physical Health outcomes in children and adolescents. The present study shows a new field such as psychoso-

cial benefits that may be of great importance in the relevance of developing active commuting programs

6. Prospectives of future

It is necessary to continue investigating AC to school, as interesting results and improvements have been revealed by the interventions proposed to date, but more scientific studies are necessary. Therefore, it is important to increase the number of studies, to randomize them, control external contaminants, increase the duration of the interventions, and increase the psychosocial health studies.

None of the investigations analyzed was aimed at improving the levels of AC to extracurricular activities. This should be a research line to develop, as some social conditions make it easier to intervene in activity schedules and achieve better results. On the one hand, the groups tend to be smaller, the schedule is more flexible, and it is easier for families to get organized. We think that interventions can achieve a greater increase in AC during this time, and if the habit is firmly consolidated, then this pattern can be switched to school hours.

Future research on AC should focus on increasing the duration of interventions, involving the educational community (parents-teachers-administration ...) as much as possible and trying to control the biases that may arise during the investigation.

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